Modified Enlarged 24pt

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Friday 27 May 2022 – Morning

AS Level Computer Science

H046/02 Algorithms and problem solving

Time allowed: 1 hour 15 minutes
plus your additional time allowance

DO NOT USE:
a calculator

Please write clearly in black ink.

Centre number | | | | | |

Candidate number | | | | |

First name(s) _____

Last name _____

READ INSTRUCTIONS OVERLEAF

DC (PQ/SW) 318212/1

10279838896

INSTRUCTIONS

Use black ink.

Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.

Answer ALL the questions.

INFORMATION

The total mark for this paper is 70.

The marks for each question are shown in brackets [ ].

Quality of extended response will be assessed in questions marked with an asterisk (*).

ADVICE

Read each question carefully before you start your answer.

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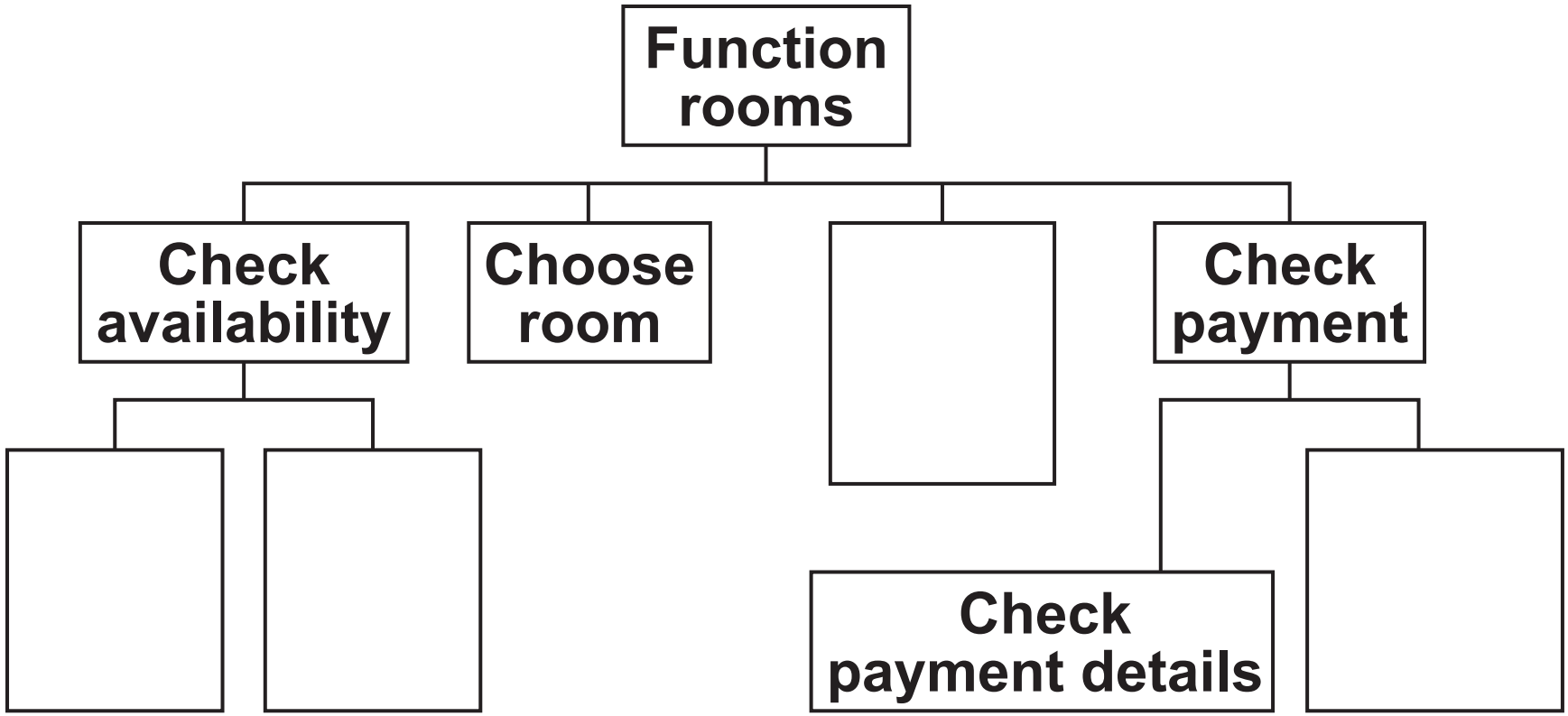
Answer ALL the questions.

1 Ruhail owns ten different function rooms which can be hired by different business customers to hold meetings. He would like a program to manage the booking process of each room.

Customers should be able to enter the date they want to hire a function room, and then a list of available rooms will be displayed. Customers can then select which room they want to hire. Customers can then enter their payment details which are then checked and then a confirmation email is sent to the customer.

(a) Complete the structure diagram opposite to show the different component parts of the problem. [4]


Function rooms
Check availability
Choose room
Check payment
Check payment details

(b) **Ruhail will make use of an Integrated Development Environment (IDE).**

State the purpose of an IDE.

_____

_____ **[1]**

(c) **State TWO different programming constructs and give an example of how Ruhail could use each construct when creating his program code.**

1 _____

_____

_____

_____

2 _____

_____

_____

_____

[4]

(d) **Ruhail will test his program code to make sure that it works correctly.**

State TWO test strategies that Ruhail could use.

1 _____

_____

2 _____

_____

[2]

(e) **Ruhail will make use of a software development life cycle methodology.**

State TWO software development methodologies that Ruhail could consider using.

1 _____

_____

2 _____

_____

[2]

(f) Ruhail has been told to make use of reusable components when creating his program code.

Explain TWO benefits of using reusable components when writing program code.

1 _____

_____

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2 _____

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[4]

2 Logan is writing a program for his customers to be able to buy his gym equipment. In the program, once a customer has selected the items they want to buy, a procedure, `checkDetails`, will be called. This procedure will check that the customer has input their telephone number and also check that it is at least 11 characters long.

(a) Logan has written two possible versions of the procedure that could be used to achieve this.

VERSION ONE:

```
procedure checkDetails()
      telephoneNo = input("Enter telephone number")
      while (telephoneNo == "") or (telephoneNo.length < 11)
            print("Error, please try again")
            telephoneNo = input("Enter telephone number")
      endwhile
endprocedure
```

VERSION TWO:

```
procedure checkDetails()
      telephoneNo = input("Enter telephone number")
      if (telephoneNo == "") or (telephoneNo.length < 11) then
            print("Error, please try again")
            telephoneNo = input("Enter telephone number")
      endif
endprocedure
```

(i) **Explain why version one is more effective than version two at making sure that the telephone number entered is at least 11 characters long.**

[4]

(ii) As well as the procedure `checkDetails`, Logan would like to use additional procedures to expand his program.

The program will be expanded to:

allow customers to be able to register an account by setting up a username and password

allow registered users to be able to log-in with their registration details

allow customers, once logged in, to be able to add items that are in stock to their online shopping basket.

State TWO other procedures that Logan could write to meet these requirements, and for each one, state a suitable name and purpose.

PROCEDURE 1:

Procedure Name: _____

Purpose: _____

_____

PROCEDURE 2:

Procedure Name: _____

Purpose: _____

_____

[4]

(iii) **When setting up the additional procedures in his program, Logan will use a mixture of parameter passing by reference and by value.**

State the difference between parameter passing by reference and parameter passing by value.

_____

_____

_____

_____ **[2]**

(b)* Logan will work in a team with five other programmers and together they will create the programming code for the program.

Discuss how modularity can be used to allow the team of programmers to work effectively together on the same program at the same time. [9]

3 Trudi would like to sort an array of numbers into order.

The numbers before they have been sorted can be seen here.

89	25	75	37	45

(a) Trudi will use a bubble sort to put these numbers into order from smallest to largest.

Show the first pass of the bubble sort. You should clearly show each comparison made.

_____

_____

_____

_____

_____

_____

_____

_____ **[4]**

(b) Trudi has written a procedure, `bubbleSort`.

(i) Identify a line in the procedure `bubbleSort` where a decision is taken.

_____

_____ [1]

(ii) Identify the name of the parameter used in the procedure `bubbleSort`.

_____

_____ [1]

(iii) Describe the purpose of the `temp` variable in the procedure `bubbleSort`.

_____

_____

_____

_____ [2]

```
01  procedure bubbleSort(numbers)
02        do
03              sorted = true
04              for count = 0 to numbers.length -2
05                    if numbers[count] > numbers[count+1] then
06                          temp = numbers[count+1]
07                          numbers[count+1] = numbers[count]
08                          numbers[count] = temp
09                          sorted = false
10                    endif
11              next count
12        until sorted == true
13  endprocedure
```

(iv) Describe the purpose of the `sorted` variable in the procedure `bubbleSort`.

_____

_____

_____

_____ [2]

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4 Given the following procedure:

(a) Explain why = is used on line 11 of the procedure `generate` instead of ==.

_____

_____

_____

_____ **[2]**

(b) State the values printed by the procedure `generate` when `number` = 8.

_____

_____ **[1]**

(c) State the values printed by the procedure `generate` when `number` = 7.

_____

_____ **[1]**

```
01 procedure generate(number)
02           a = 0
03           while number > 0
04                 if number MOD 2 == 0 then
05                       a = a + 2
06                       print(a)
07                       number = number - 2
08                 else
09                       a = a + 1
10                       print(a)
11                       number = number - 1
12                endif
13          endwhile
14     endprocedure
```

(d) **Describe the purpose of the `MOD` operator on line `04` of the procedure `generate`.**

_____

_____

_____

_____ **[2]**

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5 A veterinary surgery uses a two dimensional array to store bookings for customers to bring in their animal to see the vet. There are ten possible booking slots during each day.

An example of the two dimensional array is shown in FIG. 1.

The first column stores the booking slot number, ranging between 1 and 10.

The second column stores the time of the appointment.

The third column stores the customerID of the customer who has booked that slot.

FIG. 1

1	9:00	5877RC
2	9:30	9655AS
3	10:00	
4	10:30	8754TT
5	11:00	
6	11:30	8745SD
7	13:00	9635GH
8	13:30	
9	14:00	9874PL
10	14:30	9658SV

If a customerID has been entered for a booking slot then the booking slot has been taken. If no customerID has been entered then the booking slot is available for booking.

(a) When customers make an appointment they often ask for the first available booking slot.

Describe how a linear search could be used for this purpose.

_____

_____

_____

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_____

_____ [3]

(b) A function `findFirst`, is used to find the first available appointment.

Write the function `findFirst` that will find the first available appointment and return the booking slot number. If no appointments are available then the function should return `"-1"`.

You should write your function using pseudocode or program code.

[7]

(c) When an available time slot has been found then a valid customerID must be entered to confirm the booking.

This is checked by another function called `checkCustomerID`. This will return `true` if the customerID is valid or `false` if the customerID is not valid.

State why a function would be used instead of a procedure for this purpose.

_____

_____ [1]

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6 Kylie buys used games consoles and then sells them to make a profit. She sells her products in multiples of £5 such as £30, £55 and £95. Kylie only accepts £50, £20, £10 and £5 notes from her customers.

Kylie has written an algorithm which will calculate the amount of change needed by stating how many £20, £10 and £5 notes are needed.

The program should output the minimum number of notes required. For example if £35 change is required then it should output 1 x £20 and 1 x £10 and 1 x £5.

```
total = input("Enter total price of goods")
paid = input("Enter amount paid")
global change = paid - total
calculateChange()

procedure calculateChange()
    twenty = 0
    ten = 0
    five = 0
    while change >= 20 //Calculates number of £20 notes needed
        twenty = twenty + 1
        change = change - 20
    endwhile
    while change >= 10 //Calculates number of £10 notes needed
        ten = ten + 1
        change = change - 10
    endwhile
    while change >= 5 //Calculates number of £5 notes needed
        five = five + 1
        change = change - 5
    endwhile
    print("The amount of change you need is £" + str(change))
    print("Total £20 Notes:" + str(twenty))
    print("Total £10 Notes:" + str(ten))
    print("Total £5 Notes:" + str(five))
endprocedure
```

(a) Describe how `calculateChange()` on line 04 is used differently to `calculateChange()` on line 06.

_____

_____

_____

_____ [2]

(b) When line 22 is run, it will always print:

```
The amount of change you
need is £0
```

Explain why this error occurs when line 22 is run.

_____

_____

_____

_____ [2]

(c) **Explain why Kylie has used `str` on lines 22 to 25 in her algorithm.**

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_____

_____

_____ **[3]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

